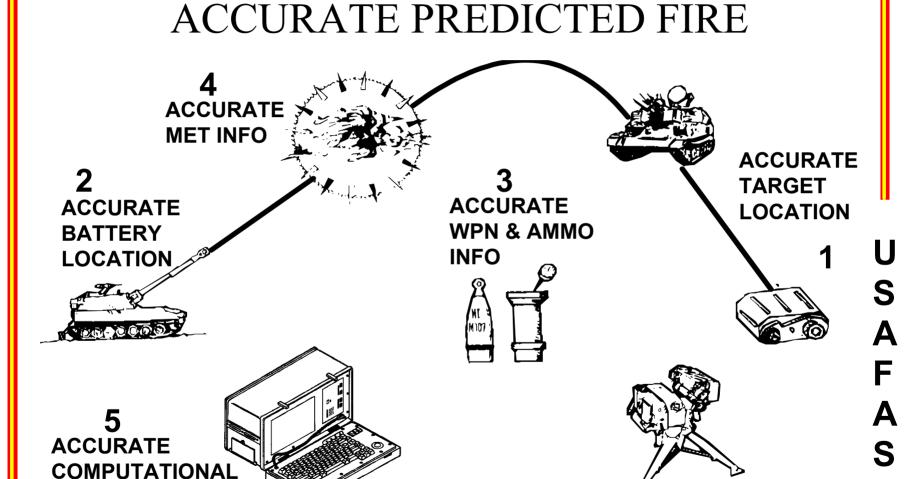


KING BATTLE

GUNNERY DEPARTMENT (**) FIVE REQUIREMENTS FOR (**)

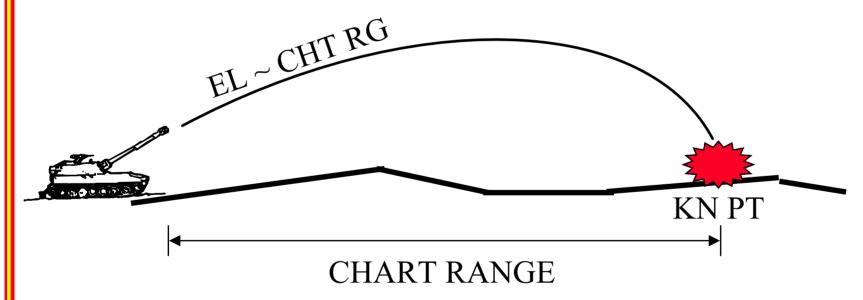


PROCEDURES



EFFECTS OF NON-STANDARD CONDITIONS

STANDARD CONDITIONS



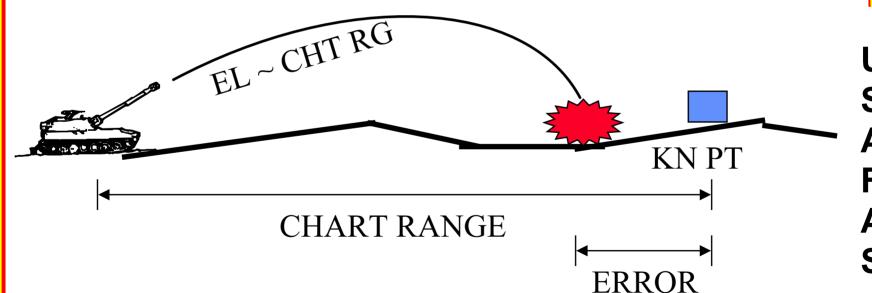
USAFAS



EFFECTS OF NON-STANDARD CONDITIONS

NON-STANDARD CONDITIONS

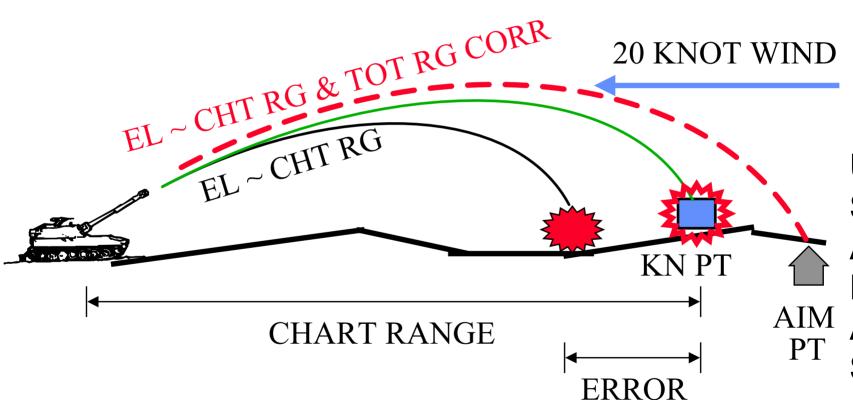
20 KNOT WIND





EFFECTS OF NON-STANDARD CONDITIONS

NON-STANDARD CONDITIONS



USAFAC



ERRORS

HUMAN ERRORS

CONSTANT ERRORS

INHERENT ERRORS



HUMAN ERRORS

- MISTAKES IN READING/SETTING UP DATA
- INACCURATE RANGE OR DIRECTION
- CARELESSNESS IN BORESIGHTING & LAYING



CONSTANT ERRORS

- DRIFT
- ROTATION OF THE EARTH
- WEIGHT OF THE PROJECTILE
- PROPELLANT TEMPERATURE
- DIFFERENCE IN ALTITUDE
- ATMOSPHERE DIFFERING FROM STANDARD (WEATHER)



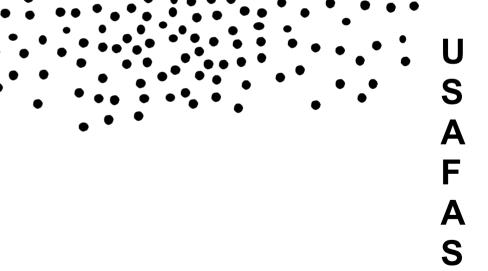
INHERENT ERRORS

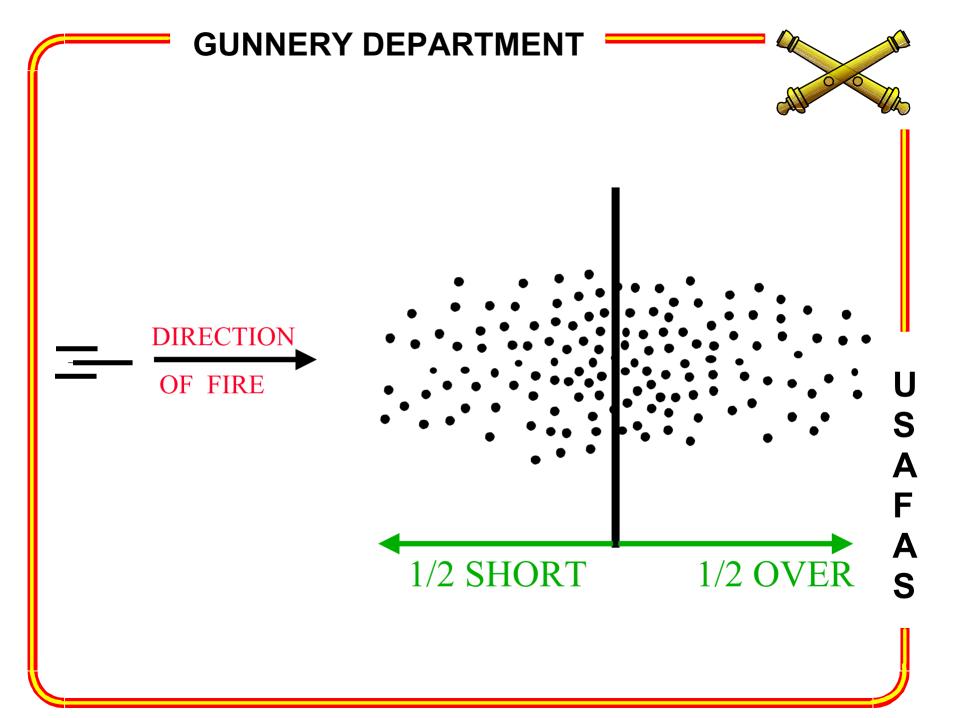
- CONDITIONS IN THE BORE
- CONDITIONS IN THE CARRIAGE
- CONDITIONS DURING FLIGHT

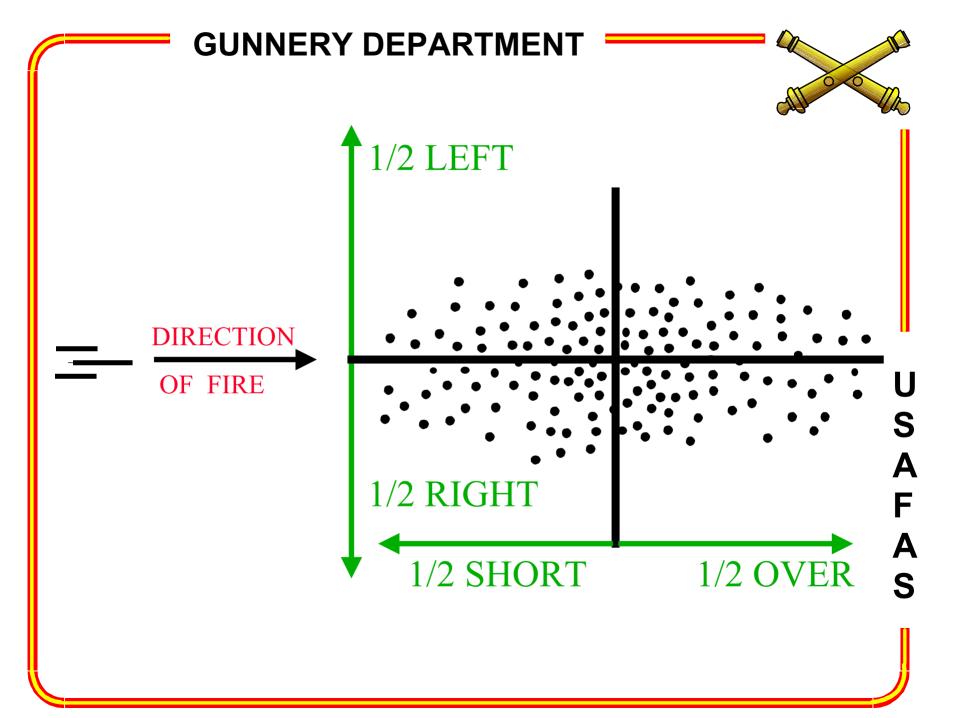


DIRECTION

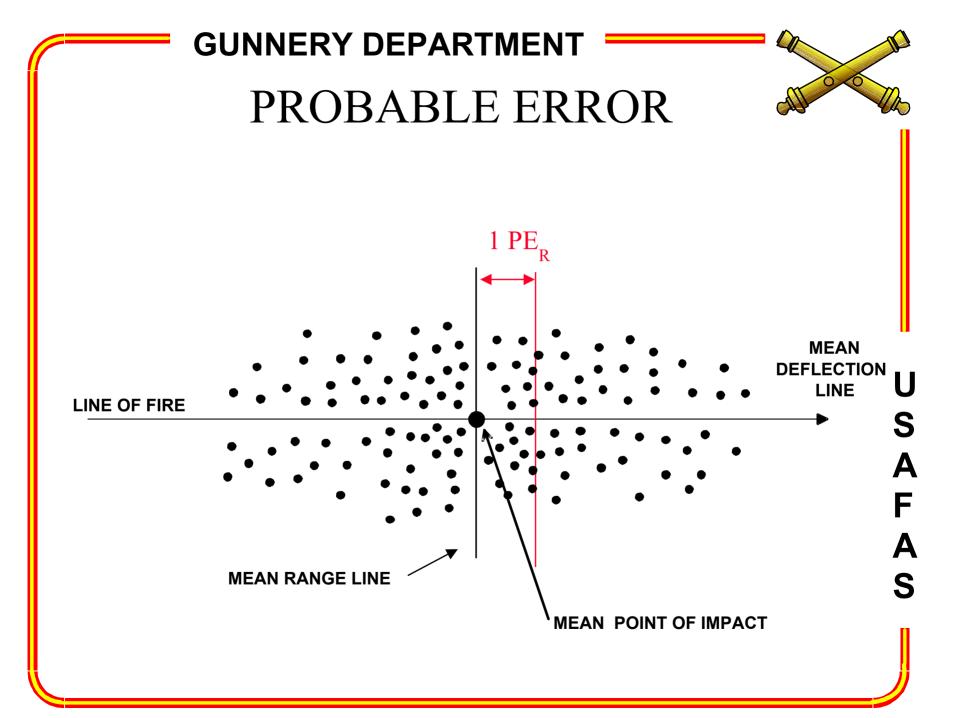
OF FIRE

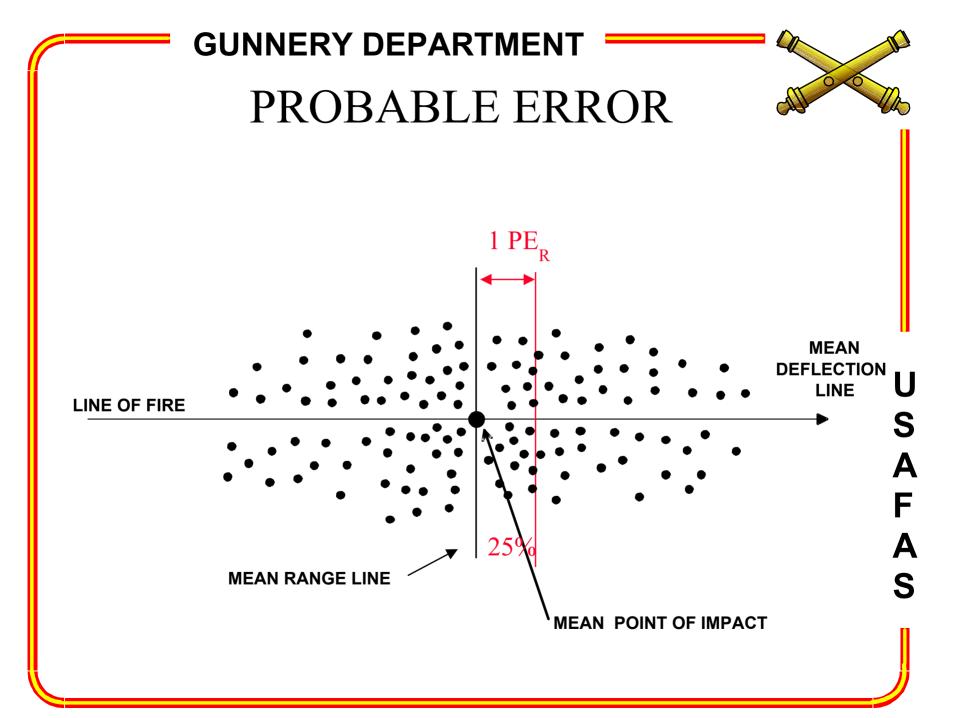






GUNNERY DEPARTMENT PROBABLE ERROR **MEAN DEFLECTION** LINE **LINE OF FIRE MEAN RANGE LINE MEAN POINT OF IMPACT**



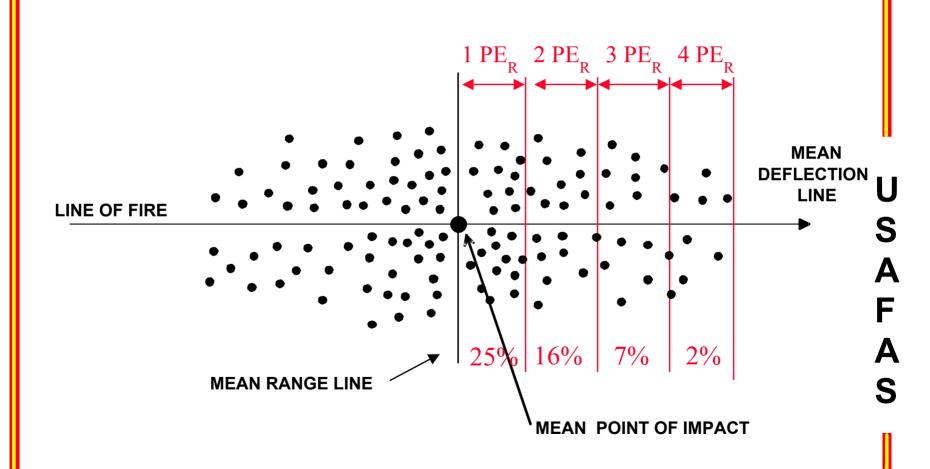


GUNNERY DEPARTMENT PROBABLE ERROR 1 PE_R 2 PE_R **MEAN DEFLECTION** LINE **LINE OF FIRE MEAN RANGE LINE MEAN POINT OF IMPACT**

GUNNERY DEPARTMENT PROBABLE ERROR $1 \text{ PE}_{R} 2 \text{ PE}_{R} 3 \text{ PE}_{R}$ **MEAN DEFLECTION** LINE **LINE OF FIRE MEAN RANGE LINE MEAN POINT OF IMPACT**

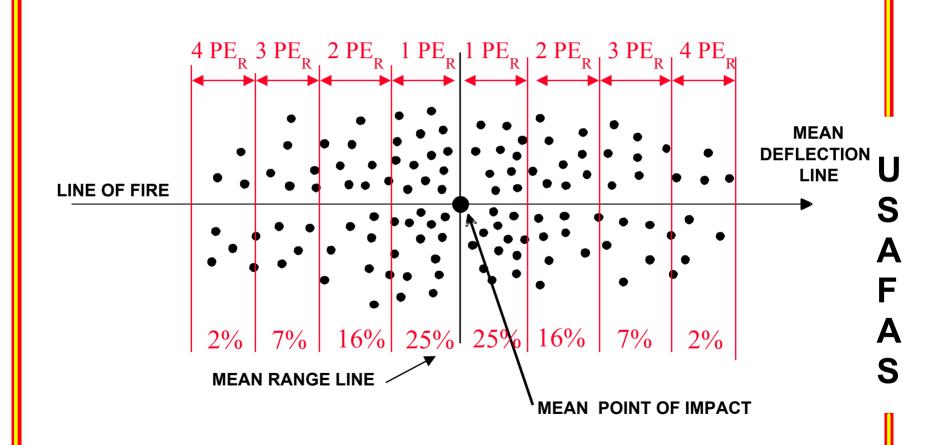
PROBABLE ERROR





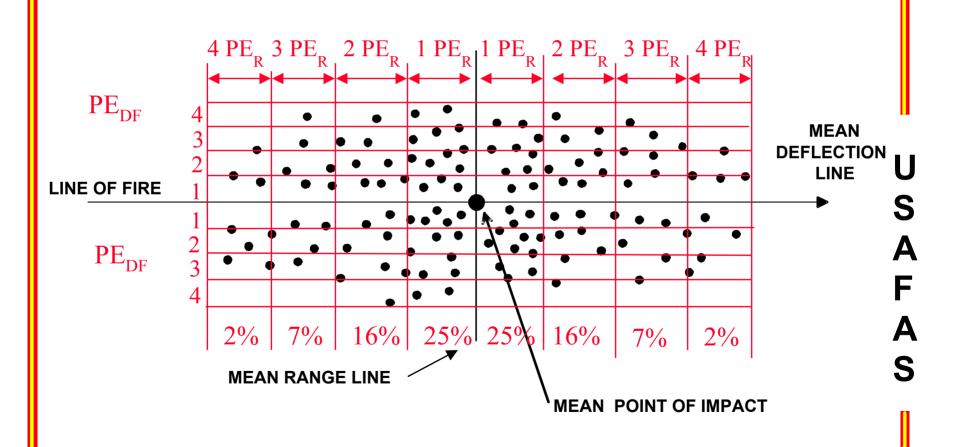
PROBABLE ERROR

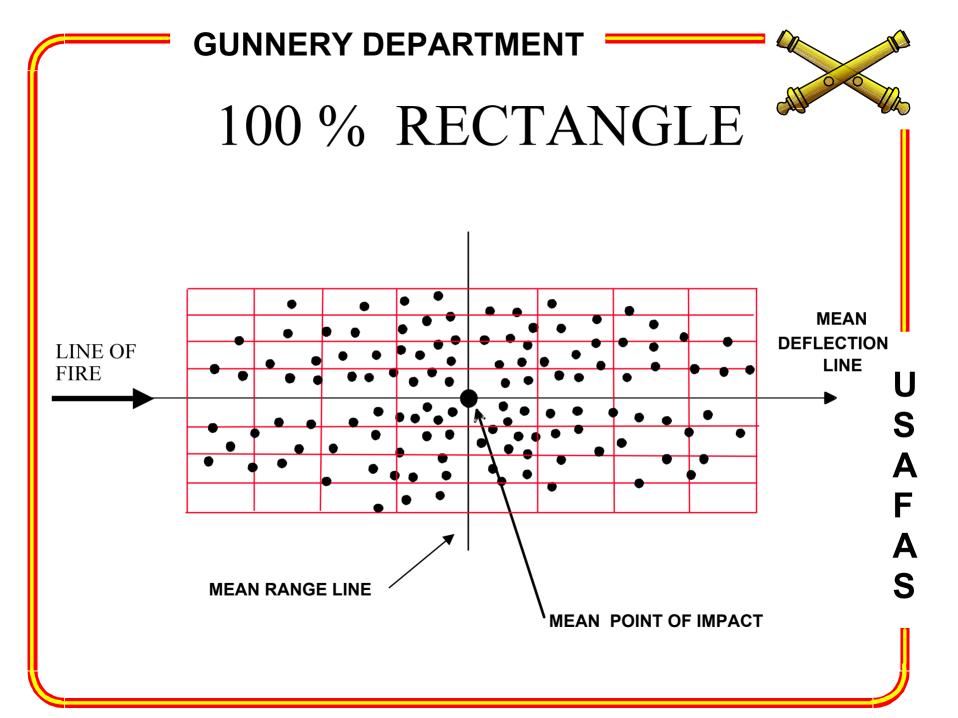




PROBABLE ERROR









100 % RECTANGLE

	.02	.07	.16	.25	.25	.16	.07	.02	
.02	.0004	.0014	.0032	.0050	.0050	.0032	.0014	.0004	
.07	.0014	.0049	.0112	.0175	.0175	.0112	.0049	.0014	
.16	.0032	.0112	.0256	.0400	.0400	.0256	.0112	.0032	
.25	.0050	.0175	.0400	.0625	.0625	.0400	.0175	.0050	
.25	.0050	.0175	.0400	.0625	.0625	.0400	.0175	.0050	LINE OF FIRE
.16	.0032	.0112	.0256	.0400	.0400	.0256	.0112	.0032	
.07	.0014	.0049	.0112	.0175	.0175	.0112	.0049	.0014	
.02	.0004	.0014	.0032	.0050	.0050	.0032	.0014	.0004	

USAFAC

ASSURANCE OF REGISTRATION VALIDITY

NUMBER OF ROUNDS FIRED	1	2	3	4	5	6
WITHIN 1 PROBABLE ERROR	50%	66%	76%	82%	87%	90%
WITHIN 2 PROBABLE ERRORS	82%	94%	98%	99%	99%	99%

USAFAS



5 STEPS TO IMPROVED FIRING DATA

- 1 CAUSE RDS TO BURST AT POINT OF KNOWN LOCATION
- 2 DETERMINE SHD AND DHD
- 3 DETERMINE TOTAL CORRECTIONS
- **4 ISOLATE POSITION CONSTANTS**
- **5 UPDATE TOTAL CORRECTIONS**



5 STEPS TO IMPROVED FIRING DATA

1. CAUSE RDS TO BURST AT POINT OF KNOWN LOCATION

OBSERVERS DUTY. MUST ACHIEVE OBJECTIVE FOR PRECISION REGISTRATION OR OBSERVE AND SPOT ROUNDS FOR HIGH BURST/MPI



5 STEPS TO IMPROVED FIRING DATA

2. DETERMINE SHD AND DHD

FDC'S DUTY. BY PROCESSING THE MISSION THE FDC DETERMINES
SHOULD HIT DATA(SHD) AND DID HIT DATA (DHD) TO THE KNOWN POINT



• SHOULD HIT DATA (SHD)
(CHART DATA)

DATA FIRED UNDER STANDARD
CONDITIONS THAT WILL CAUSE THE
ROUND TO BURST AT THE POINT OF
KNOWN LOCATION



• DID HIT DATA (DHD)

(ADJUSTED DATA)

DATA FIRED UNDER NON-STANDARD CONDITIONS THAT WILL CAUSE THE ROUND TO BURST AT THE POINT OF KNOWN LOCATION



MET CORRECTIONS- (MET)

ALL NON-STANDARD CONDITIONS
FOR WHICH WE CAN ACCOUNT. IF IT
IS IN THE TFT IT IS A MET
CORRECTION



POSITION CONSTANTS- (POS)

NON-STANDARD CONDITIONS
THAT ARE SMALL IN MAGNITUDE,
DIFFICULT OR IMPOSSIBLE TO
MEASURE, AND RELATIVELY
CONSTANT



3. DETERMINE TOTAL CORRECTIONS

TOTAL CORRECTIONS (TOT) ARE THE DIFFERENCE BETWEEN DHD AND SHD. ALL TYPES OF REGISTRATIONS YIELD TOTAL CORRECTIONS. DETM GFT SETTING, APPLY TO SUBSEQUENT MISSIONS.

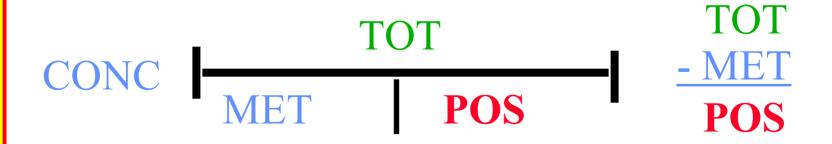
REG MET? POS? - SHD

USAFAS



4. ISOLATE POSITION CONSTANTS (CONCURRENT MET TECHNIQUE)

QUANTIFY MET CORRECTIONS AND ISOLATE POSITION CONSTANTS





5. UPDATE TOTAL CORRECTIONS (SUBSEQUENT MET TECHNIQUE)

QUANTIFY NEW MET AND ADD TO POS TO DETERMINE NEW TOT. UPDATE GFT SETTING.

SUBS NEW MET POS

NEW TOT

+POS

NEW TOT

U S A

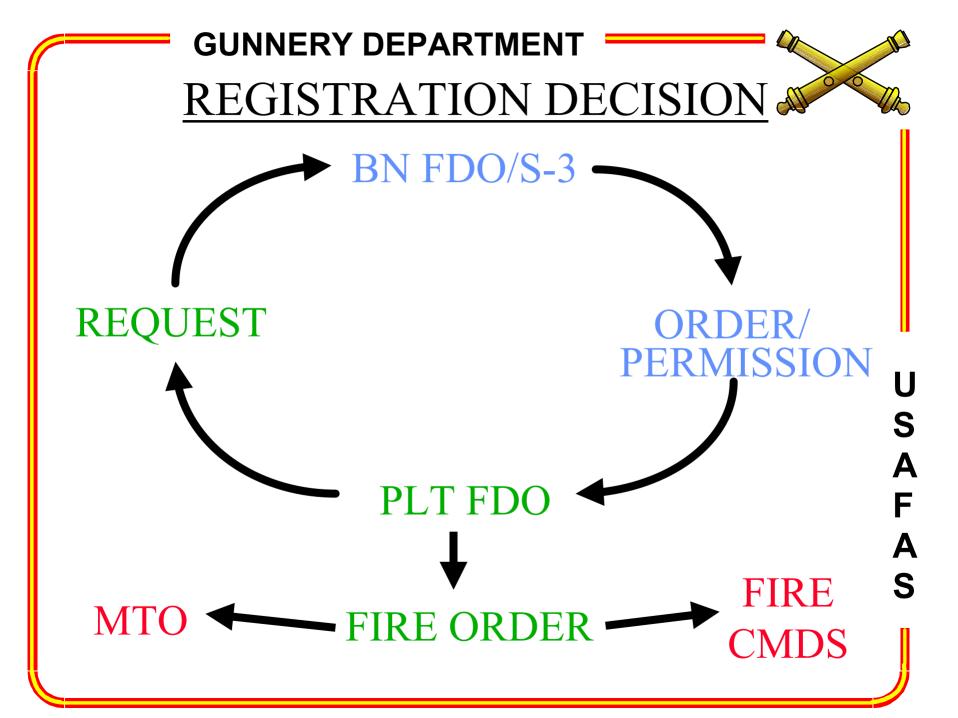
AF

S



REGISTRATIONS

U S A F A S



PRECISION REGISTRATION REQUIRES:



- A CLEARLY DEFINED KNOWN POINT
- 4 SPOTTINGS PER PHASE, Q & TI
- GOOD WEATHER AND VISIBILITY
- 10 15 ROUNDS AND 20 30 MINUTES

U S A F A S

PRECISION REGISTRATION

- FDC INITIATES REG WITH A FIRE ORDER AND MTO
- OBSERVER IDENTIFIES
 KN PT AND TRANSMITS
 DIRECTION
- FDC DETERMINES INITIAL DATA AND FIRES INITIAL ROUND
- INITIAL ROUND DOES NOT BURST AT THE KNOWN POINT





SAFAS





OBS

PRECISION REGISTRATION

- OBSERVER ADJUSTS TO THE KN PT
- OBS OBTAINS SPOTTINGS
 OF TWO OVERS AND TWO
 SHORTS WITH THE SAME
 DATA OR DATA 25 M
 APART, AND CORRECTS
 MBL TO THE KN PT
- OBS CORRECTS THE
 MEAN HOB OF 4 ROUNDS
 FIRED WITH THE SAME
 DATA TO 20 M ABOVE
 THE KNOWN POINT





REFINED MBL

KN PT



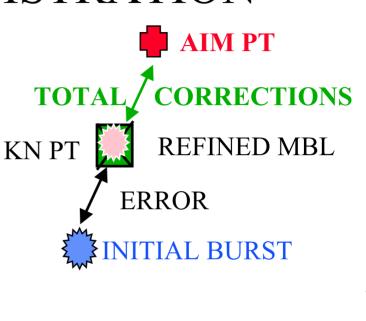
, Z

GUN OBS



PRECISION REGISTRATION

- FDC DETERMINES THE
 DIFFERENCE
 BETWEEN THE
 INITIAL DATA (SHD)
 AND THE FINAL DATA
 (DHD)TO THE KN PT
- THIS DIFFERENCE IS TOTAL CORRECTIONS, AND IS APPLIED IN THE FORM OF A GFT SETTING







OBS

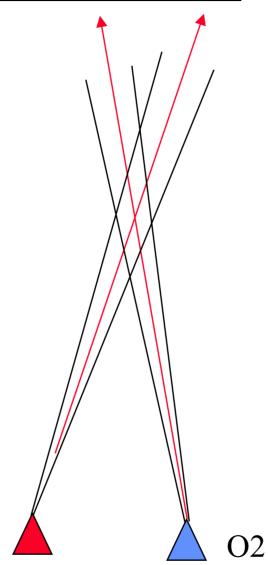
GUNNERY DEPARTMENT HIGH BURST/MPI REGISTRATION REQUIRES

- 2 SURVEYED OP'S
- ORIENTING POINT VISIBLE TO 2 OBSERVERS
- SIX USABLE ROUNDS
- EACH OBSERVER SPOTS FOR DIRECTION ON EACH ROUND, 1 SPOTS FOR VERTICAL ANGLE
- MUST MEET APEX ANGLE CRITERIA

EFFECT OF APEX ANGLE ON

O1

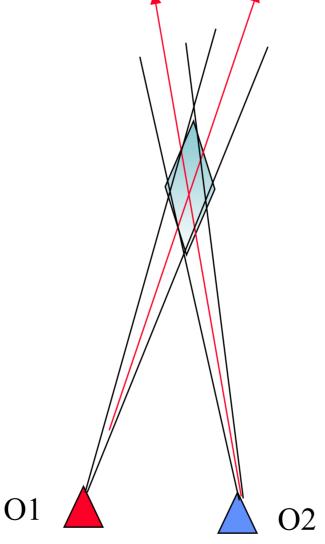
ACCURACY



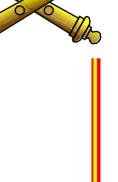


GUNNERY DEPARTMENT EFFECT OF APEX ANGLE ON ACCURACY





GUNNERY DEPARTMENT EFFECT OF APEX ANGLE ON **ACCURACY** 01



- MINIMUM APEX ANGLE 150 MILS
- ACCEPTABLE 150 TO 3050 MILS
- PREFERRED 300 TO 2900 MILS
- OPTIMUM 1067 MILS



SELECTION OF ORIENTING POINT

MPI

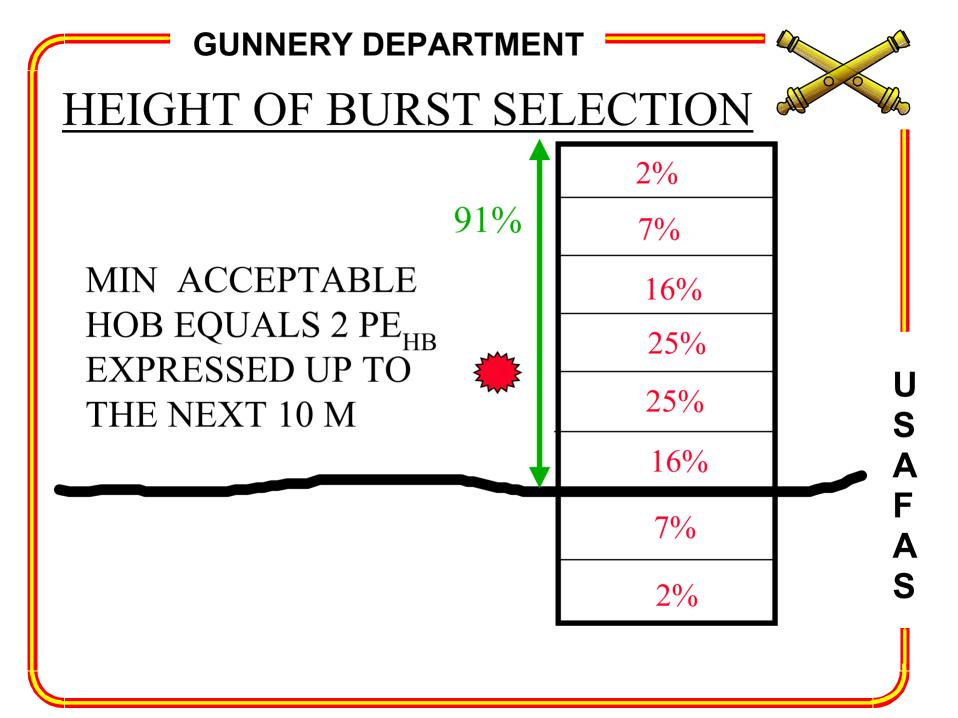
- MPI CLOSE TO CENTER OF ZONE OF ACTION
- MPI IN LEVEL AREA VISIBLE TO BOTH O1 & O2



SELECTION OF ORIENTING POINT

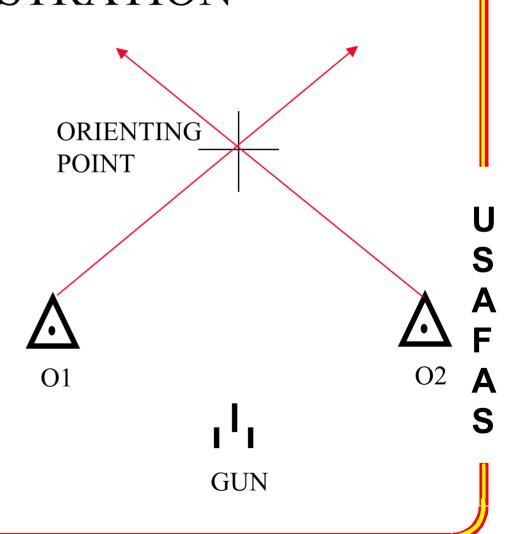
HIGH BURST

- HB OVER THE CENTER OF ZONE OF ACTION
- BURST HIGH ENOUGH TO BE VISIBLE TO O1 & 02
- BURST HIGH ENOUGH TO ENSURE AN AIRBURST



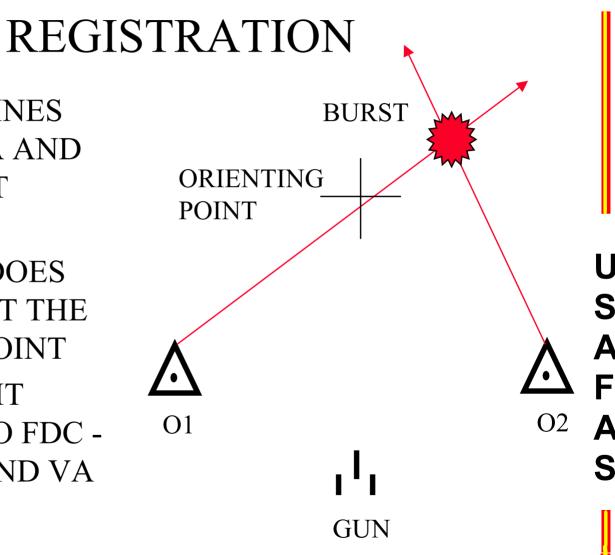
GUNNERY DEPARTMENT HIGH BURST/MPI REGISTRATION

- FDC CHOOSES A CONVENIENT ORIENTING POINT
- FDC DETERMINES
 AND TRANSMITS
 ORIENTING DATA TO
 TWO SURVEYED
 OBSERVERS
- OBS REPORT WHEN READY TO OBSERVE



GUNNERY DEPARTMENT HIGH BURST/MPI

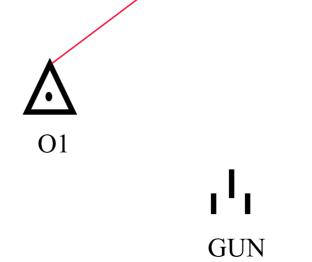
- FDC DETERMINES
 INITIAL DATA AND
 FIRES THE 1ST
 ROUND
- THE ROUND DOES NOT BURST AT THE ORIENTING POINT
- OBS TRANSMIT SPOTTINGS TO FDC -DIRECTION AND VA



HIGH BURST/MPI

REGISTRATION

- FDC FIRES REMAINING ROUNDS WITH THE SAME DATA (DHD)
- OBS TRANSMIT
 SPOTTINGS TO FDC DIRECTION AND VA
 FOR ALL ROUNDS
- FDC DETERMINES
 MEAN BURST
 LOCATION (MBL) BY
 AVERAGING ALL
 REASONABLE
 SPOTTINGS

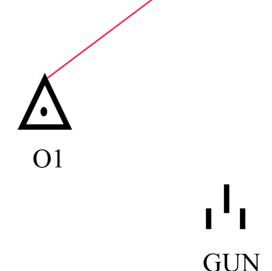




MBL

HIGH BURST/MPI REGISTRATION

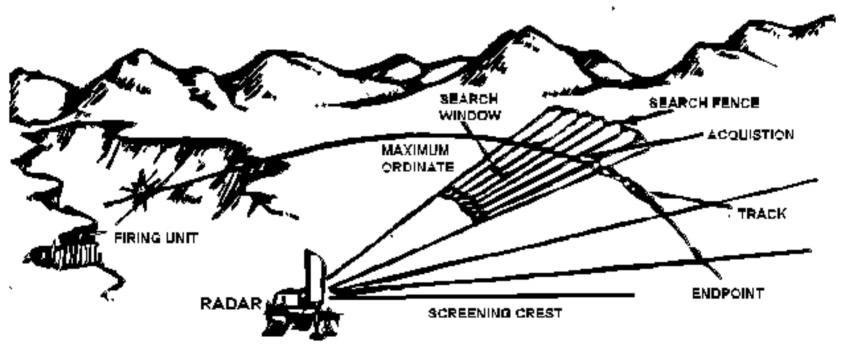
- FDC DETERMINES
 CHART DATA TO THE
 MBL (SHD)
- FDC DETERMINES
 DIFFERENCE
 BETWEEN DHD AND
 SHD THIS IS TOTAL
 CORRECTIONS
- TOTAL CORRECTIONS
 ARE THEN APPLIED IN
 THE FORM OF A GFT
 SETTING







RADAR MPI REGISTRATION



ABBREVIATED REGISTRATIONS



- ANY TYPE OF REGISTRATION CAN BE CONDUCTED AS AN ABBREVIATED REGISTRATION
- LESS THAN THE RECOMMENDED NUMBER OF ROUNDS ARE USED TO CONDUCT THE REGISTRATION
- TOTAL CORRECTIONS DERIVED HAVE A LESSER ASSURANCE OF VALIDITY
- PROCEDURES OFTEN BASED ON UNIT SOP



MET MESSAGES

USAFAS

GUNNERY DEPARTMENT MET MESSAGES



- OBTAINED FROM ARTILLERY MET SECTION VIA RADIO, TELETYPE, HAND-CARRIED, WIRE
- MET DATA DETERMINED USING TWO METHODS
 - ELECTRONIC RADIOSONDE
 - VISUAL PILOT BALLOON



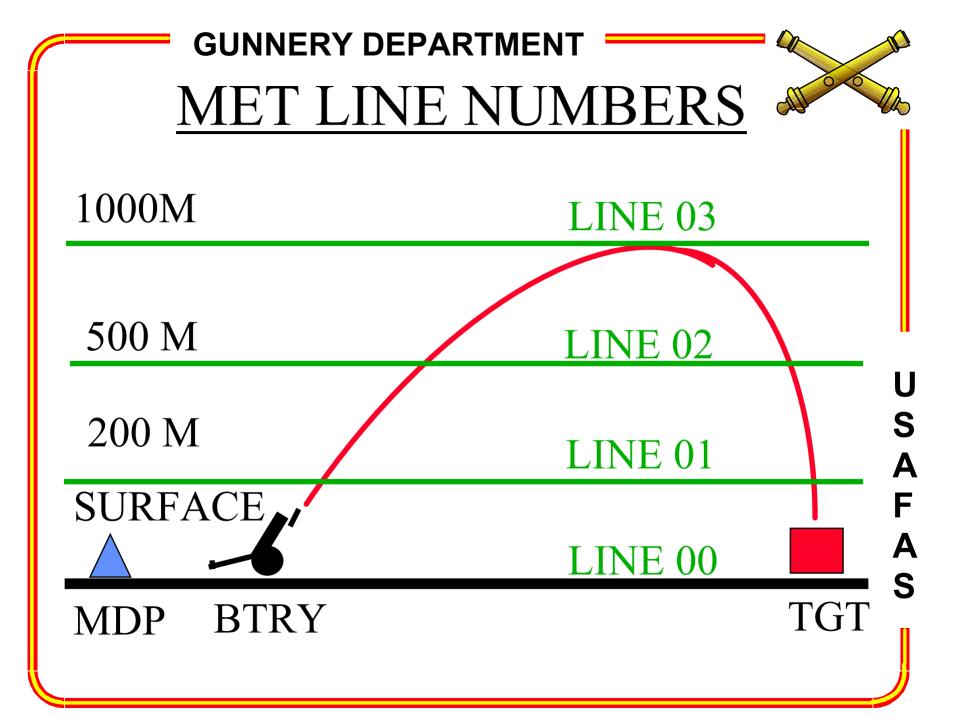
MET MESSAGES

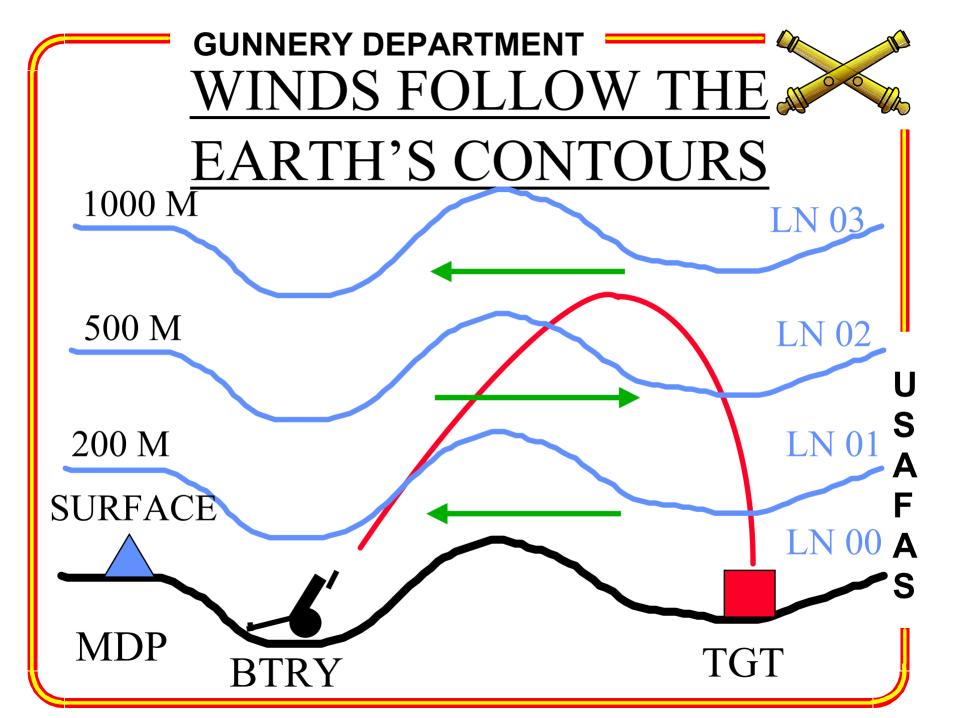
- MET MESSAGE CONTAINS
 INFORMATION ON AIR
 TEMPERATURE, DENSITY, PRESSURE,
 WIND DIRECTION, AND THE WIND
 SPEED.
- MET MESSAGE CONSISTS OF TWO PARTS
 - INTRODUCTION
 - -BODY

BALLISTIC MET



					_				Ė		
				For use of this form, see FM	IVI C I 6-15; the	Proponent agency is					
IDENTIFI- CATION METB	TYPI MSG K	OCTANT Q	L _a L _a L _a or xxx	LOCATION LoL LOCATION	o ^L o ir ix	DATE YY	TIME (GMT) G _o G _o G _o	DURATION (HOURS) G	STAT HEIO (10's	TION SHT s M) sh	MDP PRESSURE % OF STD PPP
METB					T						
<u> </u>		•	\top	BALLISTIC WINDS			BALLISTIC AIR			IR .	
ZONE HEIGHT		LINE NUMBER		DIRECTION (100's MILS)		SPEED (KNOTS)		TEMPERATURE % OF STD		DENSITY % OF STD	
(METERS)		NUMBER ZZ		dd dd		(KNOTS) FF		TTT			200
SURFACE		00									
200		01									
500)	02									
1000)	03									
1500)	04									
2000		05									
3000		06									
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8000)	10									
1000	00	11									
1200	00	12									
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1600	00	14									
1800	00	15									
REMARK	s		•					•	•		
DELIVERED TO: RECEIVED FROM:							TIME (GN	MT)	TII	ME (LST)	
MESSAGE NUMBER				DATE		1					
RECORDER					CHECKED						
DA FORM 3675								OPM 6 57 1 MA			





COMPUTER MET



COMPUTER MET MESSAGE											
IDENTIEL	For use of this form, see FM6-15; the proponent agency is TRADOC.							MDP			
CATION	OCTANT	L _a L _a L _a	CATION Lybus	DATE	TIME (GMT)	DURATION (HOURS)	HEIGHT (10's M)	PRESSURE % OF STD			
METCM	Q	or xxx	xxx	YY	Ġ _o Ġ _o Ġ	` G ′	hhh	PPP			
METCM											
				ZONE VALUES							
ZONE	LINE NUMBER	W	ND	WND SPEED		TEMPERATURE		PRESSURE (MILLIBARS)			
HEIGHT (METERS)	ZZ	(10's	CTION MILS) dd	(KNOTS) FFF		(1/10°K)		(MILLIBARS) PPPP			
SURFACE	00	d	au								
200	01										
500	02										
	03										
1000	03										
1500 2000	05										
2500	06										
3000	07						_				
3500	08										
4000	09										
4500	10										
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14000	20						-				
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19000	25	 					+				
20000	26										
	20	1	DATE & TIME	CMT		Трате	TIME (LCT				
FROM TO		DATE & TIME (GMT)			DATE & TIME (LST)						
MESSAGE NUMBER			RECORDER			CHECK	CHECKED				
i I I											

DAFORM 3677

REPLACES DA FORM 6-59, 1 MAR 62, WHICH IS OBSOLETE

BALLISTIC MET VALIDITY



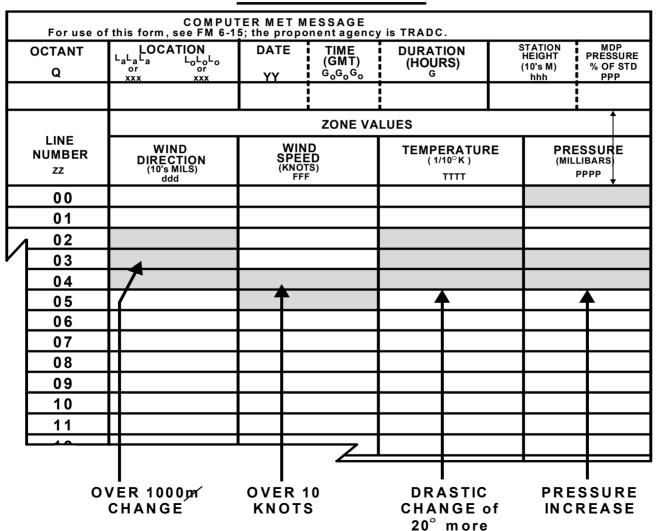
CHECKS

BALLISTIC MET MESSAGE
For use of this form, see FM 6-15; the proponent agency is TRADO

			For use of this form, see FM 6-15; the		TRADOC.				_
TYPE MSG K	OCTANT	L _a L _a L _a or	LOCATION	DATE YY	TIME (GMT) G _o G _o G _o	DURATION (HOURS) G	STATION HEIGHT (10's M) hhh	MDP PRESSURE % OF STD PPP	
	:								
			BALLIST	IC WINDS		В	ALLISTIC A	AIR	
	LINE NUMBER zz		DIRECTION (100's MILS) dd	(KN	EED OTS) FF	TEMPERATURE % OF STD TTT		DENSITY % OF STD A A A	
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	01								
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OVE	ER 1,0	/ 00m						1	•
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COMPUTER MET VALIDITY

CHECKS





MET MESSAGE PREFERENCE

- CURRENT MET MESSAGE FROM A STATION WITHIN 20 KM OF MIDPOINT OF TRAJECTORY
- CURRENT MET MESSAGE FROM THE NEAREST STATION, UP TO 80 KM FROM THE TRAJECTORY'S MIDPOINT, AND LESS THAT 2 HOURS OLD



MET MESSAGE PREFERENCE

- MESSAGE OVER 2 HOURS OLD BUT FROM A STATION 20 KM FROM THE TRAJECTORY'S MIDPOINT
- MOUNTAINOUS TERRAIN 10 KM, DISTANCES REDUCED INLAND OF COASTAL AREAS AND LARGE BODIES OF WATER BY 25%
- 4 HR MET USED EXCEPT DURING TRANSITION FROM DAY TO NIGHT AND FRONTAL PASSAGE